

Instrument Synthesis & Analysis Laboratory

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NASA

NASA GODDARD SPACE FLIGHT CENTER

Acronym List

Instrument Synthesis and Analysis Laboratory

- AO Announcement of Opportunity
- CAD Computer Aided Design
- COBE Cosmic Background Explorer
- DIRBE Diffuse Infrared Background Experiment
- DMR Differential Microwave Radiometers
- EXIST Energetic X-ray Imaging Survey Telescope
- FIRAS Far Infrared Absolute Spectrometer
- FTE Full-Time Equivalent
- GSFC Goddard Space Flight Center
- GPM Global Precipitation Measurement
- GEO Geosynchronous Earth Orbit
- HEO Highly Elliptical Orbit
- HST Hubble Space Telescope
- IDC Integrated Design Capability
- IMDC Integrated Mission Design Center
- ISAL Instrument Synthesis & Analysis Laboratory
- JWST James Webb Space Telescope
- LOE Level of Effort
- NGST Next Generation Space Telescope
- SDO Solar Dynamics Observatory
- STS Space Transportation System
- TDRSS Tracking and Data Relay Satellite System
- WFF Wallops Flight Facility

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Introduction

Instrument Synthesis and Analysis Laboratory

- What I am going to talk about:

- My background in instrument development
- Historic instruments at Goddard
- Development of the Integrated Design Capability at Goddard
- Anatomy of the Instrument Synthesis & Analysis Laboratory

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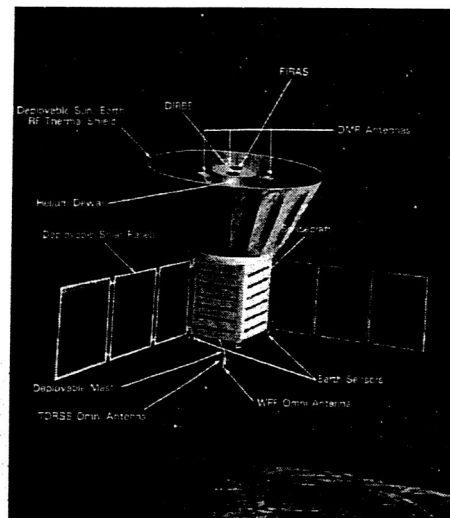
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COBE - 1984

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Hubble Space Telescope

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HST and Shuttle - 1993

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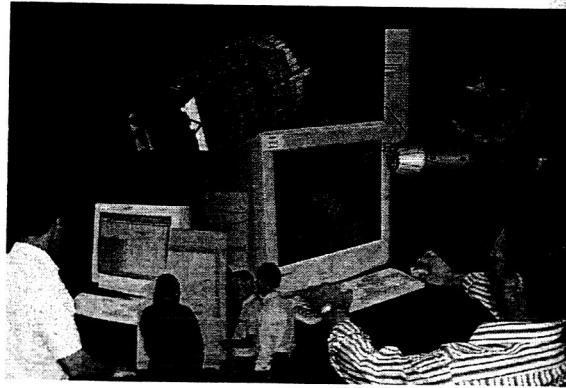
Why an Integrated Design Capability?

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- Previous concept design process:

- Too many meetings
- Too many people
- Too low on the priority totem pole
- Tied up too many resources
- Took too long to complete
- Incomplete collaboration between disciplines
- Inconsistent or non-convergent results



- Infrequent interaction with the "customer"

Did not always meet customer needs or expectations



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Proven state-of-the-art engineering...

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- Reduced cost and schedule for development of end-to-end space mission and remote sensing conceptual designs

- Previous engineering process:

- Study duration: ~ 6 months
- Level of effort (LOE): 2.5 FTEs

- IDC engineering process:

- ISAL study duration: 1 - 2 weeks
- ISAL approx. LOE: ~0.3 FTE

- IMDC study duration: 4 - 5 days

- IMDC approx. LOE: ~0.3 FTE



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Proven state-of-the-art engineering con't

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- Increased capabilities and improved consistency across studies
- Hands - on involvement of the customer in the design process
 - Customer needs and/or expectations routinely met or exceeded
- Concurrent engineering environment
 - All disciplines working together and all at the same time
 - Consider all aspects of the mission life-cycle at the same time
- Increased and improved collaboration between subsystem disciplines
 - Infuse the end-to-end system perspective into the entire team
 - Improve product consistency, quality and system level convergence
 - Improve technology infusion, especially for cross-discipline items



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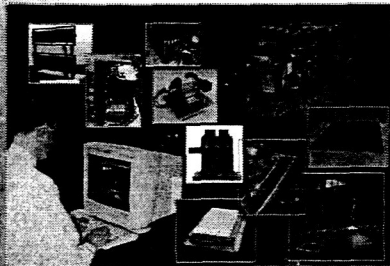
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IDC Competencies - Broad, Diverse, Customer Driven

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Integrated Mission Design Center

- LEO, HEO, GEO, libration orbits, interplanetary and deep space, balloon
- Single spacecraft missions, formation flying, constellations, distributed systems
- Uncontrolled or controlled deorbit and recoverable payload modules
- Expendable vs. non-expendable launch vehicles
- Custom vs. commercial spacecraft tradeoffs
- Nanosats to large satellites



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- Imagers, Cameras
- Spectrometers
- Lidars
- Gamma-Ray to IR Telescopes
- Solar Physics Instruments, Spectroheliographs
- Passive or Microwave Radiometers
- Optical Molecular Sensors
- Planetary & Lunar Orbiter Instruments
- Large Weather Satellite Instruments
- Geochemistry experiments



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IDC Strategic Benefits

Instrument Synthesis and Analysis Laboratory

• New Business Support

- First line of engineering analysis for Directorate/Center sanity check
- First responder team for evaluating and assessing potential GSFC new work
- In place, efficient as well as flexible, operational design environment to mature design concepts
- Produce mature design concepts that improve competitive position and provide firm basis for future life cycle activities
- "Hands on" involvement of the customer in the design process resulting in conceptual designs that better meet customer needs



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Strategic Benefits con't

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• Cross life-cycle support

- Lead trade study execution and/or maturing of design concepts
- Support Tiger Team and/or Red Team activities
- Support Confirmation Review preparation and evaluation
- Support acquisition evaluations
- Support risk mitigation process

• Technology Support

- Identification and/or evaluation of enabling technologies
- Mechanism for infusing new technologies into future concepts
- Technology roadmap development



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Why go to the ISAL?

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- Clear Proven Objectives
- Successful History
- Unprecedented Resources



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Clear Objectives

Instrument Synthesis and Analysis Laboratory

- To provide a rapid and sustainable instrument development environment with clear, efficient processes and skilled engineers.
- To provide a capability for quick and efficient trade studies of instrument architectures and concepts.
 - Supports different maturity levels
 - Direct AO response
 - Trade Studies in advance of AO
 - Instrument Incubator Program projects
 - Space Exploration Studies - new NASA Directives

To streamline and optimize instrument system design for Phase A, including cost, risk and technology assessment.



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Successful History

Instrument Synthesis and Analysis Laboratory

- Operational facility since Spring 1999
- Completed more than more than 60 studies since its inception
- Experience with Earth Science, Space Science and Space Exploration instrument projects
 - Aquarius (Sea Salinity Study) selected for Earth Science
 - SDO and GPM have asked for designs
 - EXIST selected as part of the decadal plan by the National Academy of Sciences
 - NGST (now JWST) early studies done in the ISAL



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Unprecedented Resources

Instrument Synthesis and Analysis Laboratory

- Cadre of highly-skilled discipline engineers
 - Collaboration of clients, discipline engineers, and scientists to discuss concept viability
 - Provide customized level of service
 - Detailed designs with significant analysis
- State of the Art Facility
- Strong Leadership Team
 - Unified ISAL management and operations with the Integrated Mission Design Center (IMDC) to form the Integrated Design Capability (IDC) in Spring 2001



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ISAL Engineering Skills

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- Systems
- Science Liaison
- Thermal/Cryogenics
- Optical
- Electro-Optical
- Electronics
- Electro-Mechanical
- Opto-Mechanical
- Mechanical Analysis
- Detectors
- Cost Modeling/grass roots
- Laser Technology
- Microwave Technology
- Flight Software
- Orbital Debris
- Mission Success/Risk



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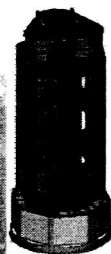
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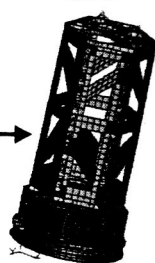
ISAL Sample Product Structural Analysis

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CAD Concept



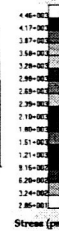
Finite Element Model



Dynamics



Stresses



Structural Deformation



Analysis Process & Products



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